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(54) Fodder

(57) A fodder comprises finely divided oil palm leaves, or the residue left after solvent extraction of a physiologically active substance from leaflets or whole leaves of oil palm.

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SPECIFICATION

Fodder

The present invention relates to preparation of a fodder from an oil palm leaf (hereinafter referred to as "OPL"). More particularly, the present invention relates to a fodder prepared by cutting and/or pulverizing OPL and, if desired, crumpling the cut and/or pulverized OPL to finely divide it, or by forming the finely divided OPL alone or together with other starting fodder material into pellets, cubes or wagers.

Furthermore, the present invention relates to a fodder formed by using a residue left after extracting physiologically active substances from a whole leaf of OPL (hereinafter referred to as "WOPL") or a leaflet of OPL (hereinafter referred to as "OPLL") with a solvent (this residue will be referred to as "extraction residue" hereinafter). More particularly, the present invention relates to a fodder comprising an extraction residue left after extraction of physiologically active substances such as vitamin E, vitamin B_1, vitamin B_2, vitamin B_6 and β-carotene from OPL with a solvent.

It has hardly been known that a fodder is prepared from OPL as it is, or cut and pulverized OPL and an extraction residue of OPL is used as a fodder.

As compared with ordinary grasses customarily used as fodders for domestic animals, such as alfalfa, orchard grass, tall oat grass, crimson clover, timothy grass, red clover, lupin, Chinese milk vetch, Kentucky bluegrass, red-top, white clover and bar clover, leaves of plants of the palm family such as OPL are usually hard, and veins and nerves are especially hard. Therefore, leaves of plants of the palm family are hardly utilized as fodders. Moreover, the crude fibre content is high but rachises of plants of the palm family are especially hard, contents of crude proteins, crude fats and nitrogen-free extract (hereinafter referred to as "NFE") are low, and therefore, they are hardly used as fodders but they are used only as fuels at the best. Among domestic animals, especially in ruminants such as cattle and sheep, feeding of a fodder containing large amounts of crude fibers is indispensable, and in animals other than ruminants, as it well-known, feeding of a crude fiber-containing fodder is important for maintenance of the health.

Rice straws or wheat straws have been used as the crude fiber-containing fodder (hereinafter referred to as "roughage"). Recently, however, rice straws and wheat straws are not easily available, and research has been vigorously made to develop substitutes for them. For example, white birch, akebia vine and bamboo grass are used, but supplies thereof are limited. Shortage of the roughage is a serious problem to be solved in rearing of domestic animals and fowls.

Formation of a fodder from OPL or the extraction residue of OPL will be an effective means for solving this problem.

For example, there is known a method in which a leaf of a plant of the palm family is decomposed with ammonia polysulfide to collect a cellulose as a paper-making stock, the waste liquid is inoculated with a yeast to effect fermentation, the residue is separated and the yeast-containing portion is used as a fodder for cattle (see, for example, German Patent No. 2,459,226). However, this method is poor in the practical utility because the chemical treatment using a particular chemical treatment is included and the steps are complicated.

It is a primary object of the present invention to provide a fodder formed by cutting and/or pulverizing OPL and, preferably, crumpling the cut and/or pulverized OPL to finely divide OPL, and to provide a valuable fodder having a good palatability of domestic animals by molding the finely divided OPL alone or together with other starting fodder material to pellets, cubes or wafers.

Another object of the present invention is to provide a valuable fodder having a good palatability of domestic animals and fowls using the extraction residue by extracting physiologically active substances contained in OPL with a solvent.

We made research with a view to attaining the foregoing objects and as a result, it was found that a fodder obtained by cutting and/or pulverizing OPL and, preferably, crumpling the cut and/or pulverized OPL promotes the palatability of domestic animals and fowls, and improves the fodder digestibility. It also was found that an extraction residue obtained by cutting and/or pulverizing WOPL or OPLL, removing water and extracting physiologically active substances such as vitamin E contained in WOPL or OPLL with a solvent promotes the palatability of domestic animals and fowls, and improves the fodder digestion ratio. We have now completed the present invention based on these findings.

More specifically, in accordance with one fundamental aspect of the present invention, there is provided a fodder comprising a finely divided oil palm leaf.

OPL consists of many leaflets and one rachis (hereinafter referred to as "OPLR"). In the present invention, the leaflet and rachis can be used singly or in combination.

In the present invention, OPL finely divided by cutting and/or pulverization and, preferably, subsequent crumpling is used.

Furthermore, a mixture of finely divided OPL and other fodder component may be used as a fodder, or this mixture is formed into pellets, cubes or wafers by a pelletizer, a cube-forming machine or a wafer-forming machine and is used as a fodder.

OPL used in the present invention is cut off when fresh fruit bunches of oil palm are harvested as the starting material of palm oil, and they are left discarded among trees of oil palm. When OPL is used in the present invention, it is preferred that OPL be treated within 2 or 3 days after cutting-off. Incidentally, 5 to 8 bunches are harvested from one tree of oil palm in a year, and OPL growing below these bunches closely thereto are ordinarily cut off when the bunches are harvested.

Since bunches of oil palm are harvested substantially throughout the year, OPL is available throughout the year. The crop of bunches of oil palm is largest when 8 to 13 years have past from the time of plating and the crop is then gradually decreased. Accordingly, after the passage of 20 to 25 years, planting is conducted again. OPL of the cut tree can also be used as the starting material in the present invention.

In the present invention, OPL is cut into 1 to 30 cm, preferably 5 to 10 cm or is not cut at all, and OPL is pulverized into 0.149 to 25.4 mm (1-100 mesh), preferably 0.297 to 4.00 mm (5-50 mesh), by a pulverizer, and if desired, the pulverized OPL is crumpled, whereby finely divided OPL to be used as a fodder is obtained. An example of the result of the analysis of the composition of OPL is shown below.

	OPLL (leaflet)	*OPLR (rachis)*
water	72 wt.%	68 wt.%
crude protein	3.4 wt.%	0.6 wt.%
crude fat	1.0 wt.%	0.2 wt.%
NFE	12.2 wt.%	11.9 wt.%
crude fiber	8.7 wt.%	18.0 wt.%
crude ash	2.7 wt.%	1.3 wt.%

The fodder component of OPLL is similar to those of alfalfa, orchard grass, red clover and green-cut oats. Furthermore, the crude fiber content of OPLR is high, and it is suggested that OPLR will be preferable as the starting material of a roughage.

Typical instances of physiologically active substances contained in OPLL and their contents (per 100 of dry OPLL) are shown below.

Vitamin E	265.5 mg
Vitamin B_1	0.3 mg
Vitamin B_2	1.0 mg
Vitamin B_6	1.3 mg
β-carotene	14.5 mg

As is seen from the foregoing, OPLL contains large amounts of physiologically active substances represented by vitamin E.

Furthermore, OPLL contains vitamin E (the majority of which is α-tocopherol having a high physiological activity) in such a large amount as 0.1 to 0.2%, and this is one of characteristic features of OPLL, because in ordinary grasses, vitamin E is contained in an amount smaller than 0.01%. From the results of animal experiments, it has been confirmed that vitamin E defficiency results in hindrance of spermatogenesis in male rats and also in hindrance of procreation by a trouble of the placenta in female rats. It is known that a peroxide is increased by vitamin E defficiency, this increase is controlled by administration of vitamin E, and vitamin E improves the permeability and strength of the blood vessel by stabilizing living body membranes such as protoplasmic membranes of endothelial cells of capillary vessel walls, mitochondria, endoplasmic recticula and lysosomes. Accordingly, if OPLL rich in vitamin E is used as a fodder, an effect of promoting the health in domestic animals and fowls can be attained.

The kind of the cutter used for cutting OPL in the present invention is not particularly critical. For example, a high speed rotary-edge cutter or a straw cutter can be used. Any of a rough pulverizer, a medium pulverizer and a fine pulverizer can be used as the pulverizer in the present invention. As typical instances of the rough pulverizer, there can be mentioned a jaw crusher, a gyratory crusher, a hammer crusher, a roll crusher, an impact crusher and a rotary crusher. As typical instances of the medium pulverizer, there can be mentioned a roller mill, an edge runner, a stamp mill, a hammer mill, a cage mill, a pin mill, a disintegrator, a dismembrator, a rotary cutter, a cutter mill, a feather mill, a rod mill, an aerofoil mill, a cascade mill, a hard cell mill, a turbo-mill, a microcyclomate and a hurricane mill. As typical instances of the fine pulverizer, there can be mentioned a pot mill, a tube mill, a conical mill, a radial mill, a tower mill, a vibrating ball mill, a sand grinder, a screen mill, a jet pulverizer and a colloid mill. A rotary crusher, an impact crusher and a rotary cutter are especially preferred. Either a continuous crumpler or a batchwise crumpler may be used. As the batchwise crumpler, there can be mentioned, for example, a ball mill, a poney mixer, a crusher, a muller mixer, a rod mixer, a twin-arm type mixer, a high-speed fluidizing mixer and an internal mixer, and as the continuous crumpler, there can be mentioned a biaxial screw mixer, a pug mill high speed rotary disk mixer, a self-cleaning type mixer, a votator type mixer, a muller, a wet mill, a roll mixer, a cokneader and a taper roll. A biaxial screw mixer, a cokneader, a continuous muller and a self-cleaning type mixer are especially preferred.

Furthermore, a machine for simultaneously effecting pulverization and crumpling, for example, a screw type mixer, can be used. Moreover, a screw type machine for simultaneously effecting pulverization, crumpling and granulation, for example, a screw type crumpling extrusion granulator, can be used.

It is preferred that cut and/or pulverized OPL be further crumpled to finely divide the pulverized OPL. If crumpling is thus conducted, the pulverized OPL is finely divided and the hard portion of OPL, for example, OPLR, is crumpled, and entire OPL is formed into a pasty product. Since the starting fodder is heated at about 100 to about 200°C by frictional heat generated by this crumpling, microorganisms and insects present in OPL are killed and lignocellulose in OPL is partially decomposed. Accordingly, the digestibility of crude fibers in the fodder by domestic animals or fowls can be increased. Moreover, starch in OPL is converted to α-starch and effectively acts as a binder at the pelletizing step, resulting in enhancement of the palatability of domestic animals or fowls and improvement of the digestibility. Simultaneously, since water is evaporated, the load for subsequent drying is reduced.

As the pelletizer for formation of pellets, there can be mentioned an extrusion-molding screw type pelletizer, a rotary perforated die type pelletizer and a rotary blade type pelletizer. Furthermore, there may be used a compression-molding compression roll type molding machine, a bricketting roll type molding machine and a tableting type molding machine, and a disintegrating rotary knife type granulator, a rotary bar granulator, a stirring pub mill type granulator, a Henschel type granulator and an Irich type granulator. A screw type pelletizer, a rotary perforated die type pelletizer and a rotary blade type pelletizer are especially preferred. Of course, the above-mentioned screw type crumpling extrusion granulator for simultaneously effecting pulverization, crumpling and granulation can be used.

For formation of cubes or wafers, cut and dried OPL is pulverized and preferably crumpled, and is then molded by an extrusion type cube-forming machine or wafer-forming machine.

Finely divided OPL can be directly used as a fodder. Furthermore, finely divided OPL is mixed with other starting fodder material and the mixture is molded. Cut and dried OPL may be mixed with other starting fodder material and the mixture is finely divided and molded. In this case, customary fodder materials may be used as the starting fodder material to be added.

For example, grains such as rice, wheat and corn, beans such as soybean and pease, oil cakes such as soybean cake, sunflower cake, coconut cake, palm press fibre, palm oil sludge, palm kernel cake and rapeseed cake, brans such as rice bran and wheat bran, potatoes such as white potato, sweet potato, potato meal, cassava, potato flake and artichoke, rootcrops such as turnip, fodder beet, radish, sugar beet and carrot, industrial sludges such as starch sludge, cassava starch sludge, glutene feed, glutene meal and molasses, animal fodders such as fish mill, fish sludge, dry chrysalis, whale meat mill, earthworm, locust, defatted milk, casein, meat mill and bone-containing meat mill, and grasses such as orchard grass, clover and alfalfa can be used. At least one member selected for the abovementioned starting fodder materials is added to OPL in an customarily adopted amount, for example, 5 to 80 times by weight of OPL, and the mixture is pulverized and, preferably, crumpled. Furthermore, finely divided OPL may be mixed with other pulverized fodder. The so-formed mixed fodder may be formed into pellets, cubes and wafers.

In accordance with one preferred embodiment of the present invention, there is provided a fodder which comprises a residue left after extracting physiologically active substances from OPLL or WOPL with a solvent (the residue will be referred to as "extraction residue" hereinafter).

In this embodiment, either the extraction residue of OPLL or the extraction residue of WOPL can be used. OPLL or WOPL is ordinarily subjected to a preliminary treatment such as fine dividing or dehydration prior to extraction. Namely, OPLL or WOPL is cut into a length of about 3 to about 4 cm and a width of 0.05 to 3 cm, preferably 0.1 to 0.5 cm, or OPLL or WOPL is not cut, and OPLL or WOPL is pulverized to 0.149 - 25.4 mm (1 to 100 mesh), preferably 0.297 - 4.00 mm (5 to 50 mesh), by a pulverizer and is then heated under atmospheric pressure or reduced pressure or treated with a solvent to remove water.

Also in this embodiment, it is preferred that OPLL or WOPL be extracted within 2 to 3 days after cutting on harvesting of bunches and the obtained extraction residue be used. Furthermore, the extraction residue obtained by extracting OPL of a cut oil palm tree can be used.

The same cutters and pulverizers as mentioned above can be similarly used for finely dividing OPLL and WOPL.

Water is removed from the finely divided OPLL and WOPL by drying by a rotary drier or by azeotropic distillation with a water-insoluble non-polar organic solvent capable of forming an azeotropic mixture with water.

The solvent and conditions used for extraction of physiologically active substances are changed according to the physiologically active substances to be extracted. As the solvent, there are ordinarily used methanol, ethanol, n-hexane, n-heptane, benzene and toluene, and n-hexane is especially preferred. When the extraction residue is used as the fodder, in view of the palatability of domestic animals, n-hexane is preferably used, but methanol or ethanol can be used. The extraction temperature is between normal temperature or room temperature and the boiling point of the solvent, preferably about 30 to about 50°C. When vitamin E is extracted as the physiologically active substance, n-hexane is used as the solvent.

The solvent is separated and removed to get the extraction residue by solid-liquid separating means such as filtration and centrifugal separation. If necessary, the remaining solvent in the extraction residue may be removed by blowing of steam or other customary means. The extraction residue can be used in the powdery state singly or in combination with other starting fodder material as described hereinbefore. If necessary, the extraction residue or its mixture with other starting fodder material may be molded into pellets, cubes or wafers in the same manner as described above.

A screw type crumpling extrusion granulator for simultaneously effecting pulverization, crumpling and granulation can be used.

As the starting fodder material to be mixed with the extraction residue, there can be mentioned those mentioned hereinbefore with respect to the fundamental aspect of the present invention.

In the so-obtained fodder, the water content is ordinarily adjusted to up to 60% by weight. When the fodder is stored for a long time, it is preferred that the water content be not more than 10% by weight.

In view of the palatability, the fodder comprising finely divided OPL, that is, the fodder of the first aspect of the present invention, is preferred. In view of the low water content, the fodder comprising the extraction residue, that is, the fodder of the second aspect of the present invention, is preferred.

According to the present invention, a valuable fodder can be obtained from OPL which has hardly been utilized but left discarded or a residue left after extraction of physiologically active substances from this OPL. Accordingly, a high resource-utilizing effect can be attained in the present invention, and the present invention makes great contributions to industries.

The present invention will now be described in detail with reference to the following examples that by no means limit the scope of the invention.

Example 1

Green OPLL was cut into a width of 1 to 2 cm by a straw cutter, and 600 g of cut OPLL (having a water content of 70% by weight) was mixed with 1400 g of a commercially available compounded fodder comprising 66% by weight of corn, 20% by weight of bran, 10% by weight of soybean cake and 4% by weight of calcium carbonate, sodium chloride and calcium phosphate. The mixed fodder was continuously given to one castrated Holstein which had been fating for 8 hours. Just after feeding, the ox showed a good appetite and ate all the fodder in 30 minutes. The palatability of this mixed fodder was better than that of rice straw and was similar to that of dry grass (alfalfa).

Example 2

Green OPLL was cut into a width of 5 to 10 cm by a straw cutter and pulverized to 0.297 to 4.00 mm (5-50 mesh) by a rotary crusher, and 600 g of the cut and pulverized OPLL (having a water content of 65% by weight) was mixed with the same compounded fodder as used in Example 1. The mixed fodder continuously given to one castrated Holstein which had been fasting for 8 hours. Just after feeding, the ox showed a good appetite and ate all the fodder in 26 minutes. The pulverized OPLL was crumpled by a biaxially screw type crumpler, and 600 g of the crumpled OPLL was mixed with 1400 g of the same compounded fodder as used in Example 1. The mixed fodder was given to one castrated Holstein which had been fasting for 8 hours. All the fodder was eaten in 25 minutes.

Example 3

Green OPLL was cut into a width of 1 to 2 cm by a high speed rotary blade type cupper and was dried by a rotary drier so that the water content was reduced to about 40% by weight, and the dried OPLL was pulverized to 0.297-4.00 mm (5 to 50 mesh) by a rotary crusher and crumpled by a biaxially screw type crumpler. A mixed fodder was prepared by mixing 5 kg of the above-mentioned pulverized OPLL or 5 kg of the crumpled OPLL with 5 kg of the same compounded fodder as used in Example 1. The mixed fodder was given to 5 sheeps as feed for 1 day (2 kg/sheep/day). The results of the digestion ratio test are shown in Table 1.

Table 1

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pulverized WOPL	36	7.8	2.3	27.8	19.9	6.2	66	50	70	55
Pulverized and Crumpled OPLL	35	7.9	2.3	28.3	20.2	6.3	68	52	75	65

Example 4

The pulverized and crumpled OPLL prepared in Example 3 was formed into a pellet A having a diameter of about 8 mm and a length of about 2 cm by a rotary die type pelletizer. The cut and dried OPLL prepared in the same manner as in Example 3 was formed into a pellet B having a diameter of about 8 mm and a length of about 2 cm by a screw type crumpling extrusion granulator. In the same manner as in Example 3, the pellets A and B were subjected to the digestibility test. The obtained results are shown in Table 2.

Table 2

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pellet A	33	8.1	2.4	29.2	20.8	6.5	70	50	75	66
pellet B	32	8.3	2.4	29.6	21.1	6.6	75	55	80	72

Example 5

A mixture of 8 parts by weight of the crumpled OPLL prepared in the same manner as described in Example 3 and 2 parts by weight of pulverized cassava was formed into a pellet C having a diameter of about 8 mm and a length of about 2 cm by a rotary disk type pelletizer. A mixture of 8 parts by weight of the cut and dried OPLL prepared in Example 3 and 2 parts by weight of cassava was formed into a pellet D having a diameter of about 8 mm and a length of about 2 cm by a screw type crumpling extrusion granulator. The pellets C and D were subjected to the digestibility test in the same manner as in Example 3. The obtained results are shown in Table 3.

Table 3

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pellet C	41.5	6.5	1.9	28.4	16.5	5.2	66	50	77	66
Pellet D	40.7	6.6	1.9	28.8	16.7	5.3	68	55	81	73

Example 6

A mixture of 7 parts by weight of the crumpled OPLL prepared in the same manner as in Example 3 and 3 parts by weight of pulverized unpolished rice was formed into a pellet E having a diameter of about 8 mm and a length of about 2 cm by a rotary die type pelletizer. A mixture of 7 parts by weight of the cut and dried OPLL prepared in the same manner as in Example 3 and 3 parts of pulverized unpolished rice was formed into a pellet F having a diameter of about 8 mm and a length of about 2 cm by a screw type crumpling extrusion granulator. The pellets E and F were subjected to the digestibility test in the same manner as in Example 3. The obtained results are shown in Table 4.

Table 4

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pellet E	27.0	8.0	2.0	43.2	14.9	4.9	74	55	85	64
Pellet F	26.5	8.1	2.0	43.5	15.0	4.9	75	58	87	68

Example 7

WOPL (including OPLL and OPLR; the same will apply hereinafter) was cut into a width of 5 to 10 cm by a straw cutter and pulverized to 0.297-4.00 mm (5 to 50 mesh) by a rotary crusher, and 600 g of the pulverized WOPL (having a water content of 65% by weight) was mixed with 1400 g of the same compounded fodder as used in Example 1. The mixed fodder was continuously given to one castrated Holstein which had been fasting for 8 hours. Just after feeding, the ox showed a good appetite and ate all the fodder in 27 minutes. The above-mentioned pulverized WOPL was crumpled by a screw type crumpler, and 600 g of the crumpled WOPL was mixed with 1400 g of the same compounded fodder as used in Example 1. The mixed fodder was given to one castrated Holstein which had been fasted for 8 hours. The ox ate all the fodder in 24 minutes.

Example 8

WOPL was cut into a width of 1 to 2 cm by a high speed rotary blade type cutter and dried by a rotary drier so that the water content was reduced to about 40% by weight. Then, the dried WOPL was pulverized to 0.297-4.00 mm (5 to 50 mesh) by a rotary crusher and crumpled by a biaxial screw type crumpler. A mixed fodder was prepared by mixing 5 kg of the pulverized WOPL or the crumpled WOPL with 5 kg of the same compounded fodder as used in Example 1, and the mixed fodder was given to 5 sheeps as feed for 1 day (2 kg/sheep/day). The results of the test of the digestibility by sheeps are shown in Table 5.

Table 5

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pulverized WOPL	37	1.2	0.4	23.4	35.4	2.6	65	50	57	48
Pulverized and Crumpled WOPL	35.5	1.2	0.4	24.0	36.3	2.6	68	52	65	55

Example 9

The pulverized and crumpled WOPL prepared in the same manner as in Example 8 was formed into a pellet G having a diameter of about 8 mm and a length of about 2 cm by a rotary die type pelletizer. The cut and dried WOPL prepared in the same manner as in Example 8 was formed into a pellet H having a diameter of about 8 mm and a length of about 2 cm by a screw type extrusion granulator. The pellets G and H were subjected to the digestibility test in the same manner as in Example 8. The obtained results are shown in Table 6.

Table 6

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pellet G	33	1.3	0.4	24.9	37.6	2.8	66	50	60	53
pellet H	31.5	1.3	0.4	25.4	38.5	2.9	68	51	71	58

Example 10

A mixture of 8 parts by weight of the pulverized and crumpled WOPL prepared in the same manner as in Example 8 and 2 parts by weight of pulverized cassava was formed into a pellet I having a diameter of about 8 mm and a length of about 2 cm by a rotary die type pelletizer. A mixture of 8 parts by weight of the cut and dried WOPL prepared in the same manner as in Example 8 and 2 parts by weight of cassava was formed into a pellet J having a diameter of about 8 mm and a length of about 2 cm by a screw type crumpling extrusion granulator. The pellets I and J were subjected to the digestibility test in the same manner as in Example 3. The obtained results are shown in Table 7.

Table 7

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pellet I	41.9	1.2	0.4	24.9	29.3	2.3	64	50	78	66
Pellet J	38.0	1.3	0.4	26.6	31.3	2.4	66	53	80	72

Example 11

A mixture of 7 parts by weight of the pulverized and crumpled WOPL prepared in the same manner as in Example 8 and 3 parts by weight of pulverized unpolished rice was formed into a pellet K having a diameter of about 8 mm and a length of about 2 cm by a rotary die type pelletizer. A mixture of 7 parts by weight of the cut and dried WOPL prepared in the same manner as in Example 8 and 3 parts by weight of pulverized unpolished rice was formed into a pellet L having a diameter of about 8 mm and a length of about 2 cm by a screw type crumpling extrusion granulator. The pellets K and L were subjected to the digestibility test in the same manner as in Example 3. The obtained results are shown in Table 8.

Table 8

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pellet K	27.5	3.3	0.6	40.0	26.3	2.3	75	58	82	56
Pellet L	25.7	3.4	0.6	41.0	26.9	2.4	77	60	86	57

Example 12

OPLL was cut into a width of 0.2 cm by a high speed rotary blade cutter, and 4 kg of the cut OPLL was charged into a flask and 12 kg of n-hexane was further added. The flask was heated and water was removed by azeotropic distillation. The azeotropic temperature was about 61°C, and about 12 hours were necessary for removal of water. Then, the content of the flask was stood still to room temperature, and vitamin E contained OPLL was extracted at 40°C with n-hexane. The extraction time was about 40 hours. The extraction residue in the flask was transferred into another flask and contacted with steam to remove the remaining n-hexane. Then, 600 g of the so-obtained extraction residue was mixed with 1400 g of a commercially available compounded fodder comprising 66% by weight of corn, 20% by weight of bran, 10% by weight of soybean cake and 4% by weight of calcium carbonate, sodium chloride and calcium phosphate. The mixed fodder was continuously given to one castrated Holstein which had been fasting for 8 hours. Just after feeding, the ox showed a good appetite, and all of 2.0 kg of the mixed fodder was taken in 1 hour and 30 minutes.

Example 13

An extraction residue was prepared in the same manner as described in Example 12 except that an extraction solvent shown in Table 9 was used instead of n-hexane, and 400 g of the extraction residue was mixed with 1600 g of the same compound fodder as used in Example 12. Thus, five kinds of mixed fodders were prepared. These five mixed fodders were continuously given to five castrated Holsteins, respectively, each of which had been fasting for 8 hours. The time for intake of all amount of the mixed fodder was examined. The obtained results are shown in Table 9.

Table 9

Extraction Solvent	*The Time for Intake of All Amount of the Mixed Fodder (hours)*
methanol	about 1.7
ethanol	about 2.0
n-hexane + ethanol	about 1.5
benzene	about 2.2
toluene	about 2.2

Example 14

The extraction residue obtained in the same manner as in Example 12 was formed into a pellet M having a diameter of about 8 mm and a length of about 1.5 cm by a screw type crumpling type extrusion granulator, and 3.25 kg of pellet M was mixed with 3.25 kg of the same compounded fodder as used in Example 12. The mixture was given to five sheeps as feed for 1 day (1.5 kg/sheep/day). The results of the test of the digestibility by sheeps are shown in Table 10.

Table 10

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Mixture of Pellet M and Compounded Fodder	13.0	11.0	1.0	38.7	27.8	8.5	68	50	71	57

Example 15

A mixture of 8 parts by weight of the extraction residue obtained in the same manner as in Example 12 and 2 parts by weight of pulverized cassava was formed into a pellet N having a diameter of about 8 mm and a length of about 1.5 cm by a screw type crumpling extrusion granulator. The digestibility test of this pellet N was carried out in the same manner as described in Example 14. The obtained results are shown in Table 11.

Table 11

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE*	*crude fiber*
Pellet N	22.4	9.1	0.9	38.1	22.5	7.0	69	50	76	58

Example 16

A mixture of 7 parts by weight of the extraction residue obtained in the same manner as in Example 12 and 3 parts by weight of pulverized unpolished rice was formed into a pellet P having a diameter of about 8 mm and a length of about 1.5 cm by a screw type crumpling extrusion granulator. The digestibility test of this pellet P was carried out in the same manner as in Example 14. The obtained results are shown in Table 12.

Table 12

	Composition (% by weight)						*Digestibility (%)*			
	water	*crude protein*	*crude fat*	*NFE*	*crude fiber*	*crude ash*	*crude protein*	*crude fat*	*NFE fiber*	*crude*
Pellet P	12.4	10.2	1.0	49.9	20.1	6.4	71	52	82	57

CLAIMS

1. A fodder comprising finely divided oil palm leaves.
2. A fodder according to claim 1, comprising cut and/or pulverized and subsequently crumpled oil palm leaves.
3. A fodder according to claim 1 or claim 2 in molded form.
4. A fodder according to any one of claims 1 to 3 consisting solely of finely divided oil palm leaves.
5. A fodder according to any one of claims 1 to 3 comprising a mixture of the finely divided oil palm leaves and other fodder material.
6. A fodder according to claim 5 comprising a crumpled mixture of the finely divided oil palm leaves and other fodder material.
7. A fodder comprising a residue left after solvent extraction of a physilogically active substance from leaflets or whole leaves of oil palm.
8. A fodder according to claim 7, comprising a residue left after extraction of the leaves by methanol, ethanol, n-hexane, n-heptane, benzene or toluene.
9. A fodder according to claim 7 or claim 8 comprising a residue left after solvent extraction of vitamin E from the leaves.
10. A fodder according to claim 7 comprising the residue left after n-hexane extraction of vitamin E from the leaves.
11. A fodder according to any one of claims 7 to 10 consisting solely of the residue left after solvent extraction of a physiologically active substance from leaflets or whole leaves of oil palm.
12. A fodder according to any one of claims 7 to 11 in molded form.
13. A fodder according to any one of claims 7 to 12 comprising a mixture of the residue left after solvent extraction of a physiologically active substance from leaflets or whole leaves of oil palm and other fodder material.
14. A fodder according to claim 33 a crumpled mixture of the residue left after solvent extraction of a physiologically active substance from leaflets or whole leaves of oil palm and other fodder material.
15. A fodder according to any one of claims 5, 6, 13 and 14, wherein the other fodder comprises grain, oil, cake, bran, potato, rootcrops, industrial sludge, animal fodder or grass.

16. A fodder according to any preceding claim having a water content of up to 60% by weight.

17. A fodder according to claim 1 substantially as hereinbefore described with reference to any one of the Examples.

18. A fodder according to claim 7 substantially as hereinbefore described with reference to any one of the Examples

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